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Size selection of prey by otters, *Lutra lutra* L.: An experimental approach

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Detailed observations of otter (*Lutra lutra* L.) foraging in freshwater habitats (stream, rivers and lochs) are extremely difficult. In these habitats, analysis of prey remains in the otters' spraints can provide some information on the sizes and species of fish taken (Webb 1975; Conroy et al. 1993). Spraint analysis has revealed that the most common freshwater prey items of otters in northern Britain and Ireland are eels (*Anguilla anguilla*) and salmonid fish (*Salmo* sp.) (Jenkins et al. 1979; Murphy and Fairley 1985; Conroy and Jenkins 1986; Kyne et al. 1989). In northeastern Scotland, where otters forage in both lochs and streams, spraint analysis indicates that salmonids are taken in relation to abundance, and no preference is shown for any particular size class (Kruuk et al. 1993). In contrast, larger eels are preferentially predated (Carss and Elston 1996). As information on the foraging behaviour of otters is unavailable, it is still unclear whether the conclusions from spraint analysis reflect size preference by otters, or differences in the vulnerability to predation by different size classes of fish (Kruuk 1995).

The purpose of this study was to investigate the size selection of otters using the two most common freshwater prey species (eels and salmonids) in an experimental situation. By offering captive otters a choice between two fish of different size, we investigated the size selection of prey independent of the availability of size classes.

Prey selection trials were performed with 4 (2 male; 2 female) captive otters housed at the Institute of Terrestrial Ecology, Banchory, Scotland. Their normal diet of chicken and haddock was supplemented or replaced by experimental trials, using either brown trout (*Salmo trutta*) or eels (*Anguilla anguilla*). All animals were exposed to both eel and trout prior to the experiments. All fish were obtained by electrofishing at nearby lochs and rivers. Fork length (trout) or total length (eels) was measured to the nearest mm. Fish were then frozen at –20 °C. In preparation for experimental trials, the fish were removed from the freezer, and placed in a cold room (2–5 °C) to defrost for 24 hours.

All trials were performed by offering a choice of two prey items of the same species. The fish were placed on a tray, such at the fish were visible and could be taken only from the front of the tray. We randomly selected the side of the tray where the larger fish was placed. Only one otter was present in the compound while trials were taking place. The tray was lowered into the compound, and the otter was allowed to choose a prey item from the tray.

Binomial tests were used to determine whether the probability of first choosing the larger fish was significantly different from 50%. Significance was accepted at $p = 0.05$.

Data were collected from 85 trials using eels and 221 trials using trout as the prey species. The difference in the number of trals involving eels and trout reflected the availability of each species of fish. Eels used for selection trials ranged in length from 152–622 mm, with a range of length differences during trials of 4—304 mm. Lengths of trout ranged from 51–196 mm, and the length difference between trout ranged from 1–109 mm. These ranges corresponded with the sizes of prey taken by otters in the wild (trout, 19–250 mm; eels, 130–620 mm; Jenkins et al. 1979; Jenkins and Harper 1980; Kruuk et al. 1993).

The results of length selection trials involving eel are shown in table 1. The probability of the larger eel being taken was always greater than 50 % and statistically significant for 6 of the 8 length difference categories, resulting in a significant tendency to select the larger eel. Overall, otters appear to show selection for the larger eel (larger eel taken in 72 of 85 trials; sign test significant at $p < 0.001$), even when the length difference between the two eels is small.

The results of the trout length selection trials are shown in table 2. The larger of the two trout was selected more than 50% of the time in only 6 of the 10 categories, and this was significant in only one category. Thus, we conclude that there was no size selection for trout when examining absolute length difference. Overall, it appears that otters show no size selection for trout (larger trout taken in 117 of 221 trials; sign test non significant at $p = 0.5$).

Table 1. Results of selection trials examining length differences between eels. Asterixes indicate length difference categories where the probability of taking the larger fish was significantly greater than 50% (Binomial test).

Length Difference Category	Number of Trials	Larger Fish Taken	% Larger Fish Taken
0–39 mm	22	17	77.3*
40–79 mm	22	21	95.5*
80–119 mm	10	6	60.0
120–159 mm	8	7	87.5*
160–199 mm	9	8	88.9*
200–239 mm	4	3	75.0
240–279 mm	5	5	100*
280–319 mm	5	5	100*

Table 2. Results of selection trials examining length differences between trout. Asterixes indicate length difference categories where the probability of taking the larger fish was significantly greater than 50% (Binomial Test).

Length Difference Category	Number of Trials	Larger Fish Taken	& Larger Fish Taken
1–9 mm	37	19	51.4
10–19 mm	32	12	37.5
20–29 mm	29	15	51.7
30–39 mm	25	12	48.0
40–49 mm	28	15	53.4
50–59 mm	21	9	42.9
60–69 mm	24	16	66.7
70–79 mm	11	10	90.9*
80–89 mm	9	7	77.8
90 + mm	5	2	40.0

The conclusion that in a captive, experimental situation, otters show a preference for larger eels, but no size selection for trout is in agreement with observations in the field in northeast Scotland (Kruuk et al. 1993; Carss and Elston 1996).

The pattern of prey selection observed may be at least partly explained by the variation in lipid content of different sized fish, in that a proportionately greater lipid reward may be achieved by selecting the larger eel, even when the length difference is small (Degani et al. 1986). In contrast, even though a larger trout offers a larger meal, the lipid content does not vary greatly between different sizes of trout (Elliot 1976). This suggests that the nutritional value of prey may play a role in prey selection in captivity. However, the relative importance of the nutritional value of prey in the wild may be offset by other factors such as density of prey and competition.

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